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Forest Insect and Disease Management

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BIOLOGICAL
EVALUATION R2-77-13

MOUNTAIN PINE BEETLE
COLORADO FRONT RANGE

Arapaho and Roosevelt,
Pike and San Isabel
National Forests and
Adjacent Lands

DECEMBER 1977

Rocky Mountain Region

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INTRODUCTION

The mountain pine beetle (MPB) outbreak in ponderosa pine along the Colorado Front Range was evaluated by personnel from the FIDM Staff Unit, Regional Office during the fall of 1977. The information for the evaluation was obtained primarily on Federal lands. Evaluation of the infestation on State and private lands is the responsibility of the Colorado State Forest Service.

Estimates based on aerial and ground surveys indicate that there are approximately 825,000 infested trees on 300,000 acres of Federal land in 1977. The 1976 estimate was approximately 660,000 trees infested on 280,000 acres of Federal land. 1/ It is estimated that approximately 1,250,000 trees were infested on Federal, State and private lands by MPB in 1977. The estimate is based on a build-up ratio of 1 to 1.25 infested trees for 1976 and 1977, respectively.

TECHNICAL INFORMATION

CAUSAL AGENT: Mountain pine beetle - *Dendroctonus ponderosae* Hopkins

HOST: Ponderosa pine - *Pinus ponderosa* Laws
Lodgepole pine - *P. contorta* var. *latifolia* Engelmann
Limber pine - *P. flexilis* James

EXTENT OF INFESTATION: The mountain pine beetle is found from a few miles south of Westcliffe, Colorado to just north of the Wyoming State line, on lands of all ownerships.

TYPE OF DAMAGE: Groups of infested trees range in size from a few (3 to 5) to extensive groups of a thousand or more. Tree mortality mostly occurs in overstocked stands of poor vigor, although mortality may occur in other stands because of poor site or tree condition.

1/ Creasap, V. L. M. and C. D. Minnemeyer. 1976. Mountain pine beetle; Colorado Front Range. USDA, For. Serv. Rocky Mtn. Region. Bio. Eval. R2-76-9. 12 pp.

LIFE HISTORY: The mountain pine beetle has one generation per year. Adults attack trees from mid-July through early September by boring through the bark to the cambium. The females then tunnel upward for 12 to 30 inches (these tunnels are called egg galleries). The females lay eggs in individual niches along each side of the gallery which is then packed with frass. After hatching the larvae feed in individual channels (larval galleries) at right angles to the egg galleries in the phloem. The insect overwinters in the larval stage. In the spring, when the larvae are fully developed, they excavate an oval chamber at the end of the larval gallery (pupal chamber) and pupate. Finally, mature adults emerge from the pupal chamber by boring through the outer bark and fly to attack new trees, completing the generation.

METHODS

During the fall of 1977, after beetle flight, FI&DM personnel conducted a build-up ratio survey. One-chain-wide by one-mile long cruise strips were used to obtain build-up ratio data. Variable point prism plots (10 BAF) were taken at five-chain intervals along the cruise strips to obtain stand composition data.

In previous evaluations, the Colorado Front Range had been divided into three areas. These areas were; the "North Front Range" (from Buckhorn Canyon north to the Wyoming State line), the "Middle Front Range" (from Buckhorn Canyon south to west of Boulder), and the "South Front Range" (consisting of the Pike National Forest). This year the designations have been changed since the San Isabel National Forest is showing a substantial increase in the extent of its infestation. The "North Front Range" is now called the "North Roosevelt", covering the same area as before. The "Middle Front Range" is now called the South Roosevelt, (covering the area from Buckhorn Canyon to the Pike National Forest boundary) including a portion of the Arapaho National Forest. The "South Front Range" is now designated as the Pike National Forest. The San Isabel National Forest has been added as a fourth division of the Colorado Front Range.

RESULTS

The overall build-up ratio for the Colorado Front Range is 1 : 1.25 (1976- to 1977-infested trees). When the Front Range is divided into geographical areas (as listed previously) the build-up ratio

is found to increase from north to south. The North Roosevelt, which has had the greatest loss over the past few years, shows a reduction of 1 : 0.73. The South Roosevelt which has had slightly less loss over the past few years shows a build-up ratio of 1 : 0.85. The Pike National Forest shows a build-up ratio of 1 : 1.5, while the San Isabel National Forest, which has had major beetle activity for the least amount of time, on Federal lands shows a build-up ratio of almost 1 : 5 (Table 1). In general, suitable host material decreases progressively from south to north, due to the already mentioned pattern of recent losses. The MPB can be expected to be most active on the Pike and San Isabel National Forest.

The average DBH for 1977-infested ponderosa pine for the Front Range is 9.8. Going south from the North Roosevelt by areas, the average DBH for infested ponderosa pine is 8.2, 9.6, 9.9, and 11.0, respectively. This is expected, since more of the larger trees have been killed in previous years in the northern areas, while the southern areas still have large numbers of live larger pines.

DISCUSSION

Suppression efforts on National Forest land have consisted primarily of salvage logging of infested trees and silvicultural treatment of infested stands. The most effective way of preventing loss to MPB over a long period of time is to maintain growing stock levels (GSL) at 80 or less, depending on site. Direct control effort, such as removal of infested trees or chemical treatment, at best, only provide temporary relief from the beetle population and do not provide long term protection for the stands.

During the past year, the Arapaho and Roosevelt, Pike and San Isabel National Forests and the Colorado State Forest Service removed 167,993 infested ponderosa pine along the Colorado Front Range by salvage logging and chemical treatment. This is approximately 17% of the trees infested in 1976.

Some stands on poor sites, particularly at lower elevations, will not achieve a GSL of 80. Thinning of smaller diameter stems on these sites will help prevent stagnation. There is, at present, no silvicultural treatment known for larger diameter stands growing under these conditions. On poor sites, growing stock levels may have to be reduced below GSL 80, with emphasis placed on removing mature, overmature, damaged and dwarf mistletoe infected trees which may be more susceptible to beetle attack.

Control efforts must be properly done. If infested trees are left standing or felled and left in the woods through beetle flight, or trees are cut during flight season (so beetles are drawn into the stand) poor control will result (see Figure 1).

The Colorado Front Range Vegetative Management Pilot Project area lies just west of Boulder, Colorado. This area of 34,000 acres has been set up to operationally test the feasibility of a vegetative management project on intermingled land ownerships to retain or enhance recreation, wildlife, and scenic values to reduce tree loss by the MPB, and to reduce the hazard from wild fires. If this project is satisfactory, this management concept may be applied to an acceptable level over the entire Front Range. Tree mortality due to MPB in this area has been extremely high during the past few years.

Strip cruises within the area indicate that the beetle is on the decline. FI&DM staff will intensively monitor this area for MPB loss for 5 years after completion of this project. The rest of the Front Range will also be monitored at a less intensive rate.

ALTERNATIVES

Alternative 1: Silviculturally treat of all operable stands to reduce GSL to 80 or less, depending on site. This should reduce the susceptibility of ponderosa pine stands to epidemic MPB attack for periods of 20 years or more. Uneven age stand management often requires a partial cut at intervals of 20 years. Therefore, the concept of reducing GSL to 80 or less, depending on site, with the expected protection of the stand from beetle attack for 20 years or more, agrees with current silviculture guidelines.

Alternative 2: Salvaging of infested timber would remove dead or dying trees so that they may be utilized rather than wasted. This proposal will not reduce the susceptibility of the stands to mountain pine beetle attack. The stands may become reinfested within a few years. Salvage logging will improve the aesthetics of a stand by removing unsightly dead trees. Salvage logging should be used in areas where the remaining stand will receive silvicultural treatment within 3 or 4 years. Salvage logging of green infested trees alone is only a temporary measure to reduce beetle populations and cannot be expected to give protection to a stand for more than 3 or 4 years.

Alternative 3: Doing nothing to alleviate the pressure of mountain pine beetle attack in ponderosa pine forests is another option, but is often an unacceptable alternative. The aesthetic values of stands are reduced by leaving large patches of snags. Removal of dead trees also tends to aid the regeneration. Dead trees will result in increased fire hazard for a few years. During periods of very high or extreme fire danger, forest use may have to be restricted or completely closed down during high recreational use times because of the low fuel moisture content of large amounts of available fuel.

Alternative 4: Direct control by chemical treatment or burning of infested trees is another alternative. In order to use direct control a benefit/cost analysis should be done. Silviculturally or biologically, direct control alone cannot be justified except for short-term relief. Direct control is only a temporary course of action which will not protect a stand from beetle attack for more than 3 or 4 years. This option may be useful for areas that are scheduled for silvicultural treatment within three to four years.

RECOMMENDATIONS

Alternative 1 should be the primary control measure used by land managers. In some cases one of the other alternatives may be applicable. Land managers should carefully consider situations in which other alternatives are proposed. If alternative 1 can even be partially applied, it should be used in conjunction with other selected alternatives. Where practical, salvage logging should be followed by silvicultural treatment 3 to 5 years after salvaging. It is also recognized that some inaccessable or inoperable areas will not receive any kind of treatment. To qualify for FI&DM funding for direct control by chemical treatment, salvage logging, or burning of infested trees the benefit/cost analysis [2/] must be favorable and the project must also be environmentally acceptable.

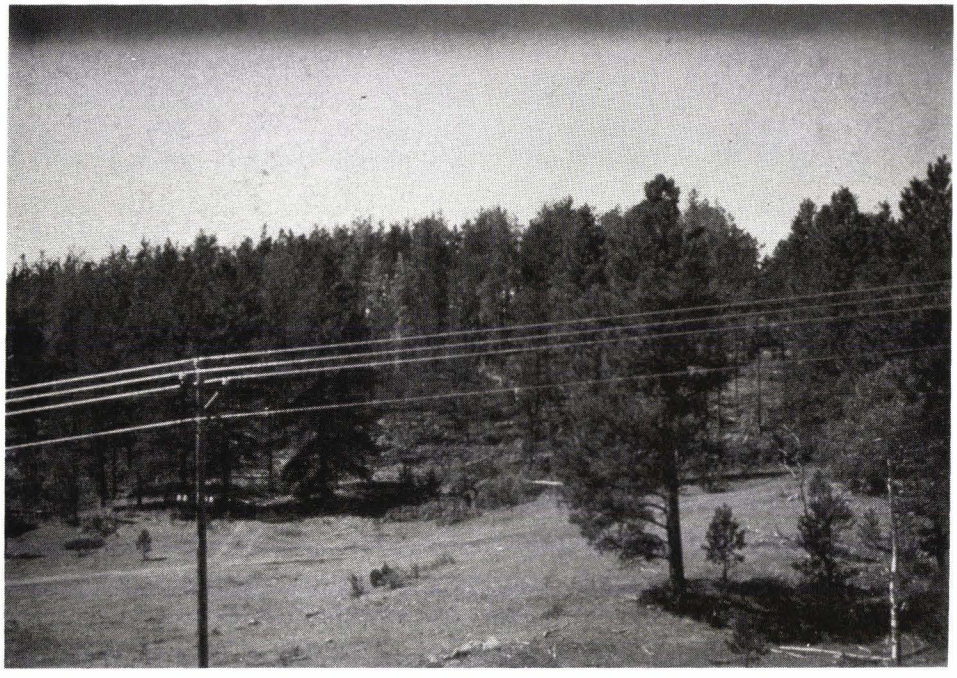
2/ Averill, R. D., J. E. Gunter, C. K. Lister, and D. H. Sonnen. 1977. Benefit/cost guidelines for bark beetle control. USDA, For. Serv. Rocky Mtn. Region. Tech. Rept. R2-11. 30 pp.

Chemical control is an alternative which may be used for protecting particularly high value trees, as around private dwellings or camp grounds. Products registered in Colorado for this purpose are "Pine Tree and Ornamental Spray" (carbaryl) and certain formulations of lindane for preventive use. Lindane and ethylene dibromide are registered for use for direct control on infested trees. Pesticides should be applied as directed on the label.

TABLE 1 BUILD-UP RATIO SUMMARY

AREA	NUMBER OF PLOTS IN TYPE	MILES OF LINE	INFESTED TREES 1977	INFESTED TREES 1976	SITE CLASS	AVERAGE BASAL AREA
North Roosevelt National Forest						
Bennett Creek	14	1.00	19	23	35	48.57
Buckhorn	16	1.00	3	7	36	45.00
Lady Moon Lake	16	1.00	17	7	38	67.50
Mill Creek	16	1.00	6	4	34	52.50
Nelson Spring (Rocky Mtn. National Park)	10	0.62	30	8	36	95.00
Prairie Divide	16	1.00	0	3	31	40.62
Salt Cabin Park	20	1.25	32	94	45	60.00
Total	108	6.87	107	146		
Average					36	56.67
Build-up Ratio			1 : 0.73			
South Roosevelt National Forest						
Beaver Meadows	20	1.25	112	58	65	103.00
Jamestown	17	1.25	16	5	65	67.06
Johnny Park	17	1.25	14	48	45	64.70
Panarama Peak	20	1.25	4	43	40	64.00
Sunset	19	1.25	4	7	40	60.00
Winiger Gulch	19	1.25	38	60	35	57.84
Total	112	7.50	188	221		
Average					41	69.82
Build-up Ratio			1 : 0.85			
Pike National Forest						
Cascade	20	1.25	13	39	60	62.50
Crystola	21	1.25	98	35	60	85.24
Manitou	18	1.25	18	6	52	58.89
Payne Gulch	18	1.25	23	9	40	83.33
Top-of-the-World	20	1.25	91	72	44	72.50
Total	97	6.25	243	161		
Average					51	72.68
Build-up Ratio			1 : 1.51			
San Isabel National Forest						
Alvarado Campground	20	1.25	110	9	50	123.00
Lake Creek	20	1.25	10	5	40	101.50
Oak Creek Picnic Ground	20	1.25	22	1	50	74.00
San Isabel Lake	20	1.25	26	19	50	125.50
Total	80	5.00	168	34		
Average					48	106.00
Build-up Ratio			1 : 4.94			
FRONT RANGE TOTAL	397	25.62	706	562		
FRONT RANGE AVERAGE					45	74.96
FRONT RANGE BUILD-UP RATIO			1 : 1.26			

FIGURE 1



Mortality from mountain pine beetle in cut over stand

FIGURE 2

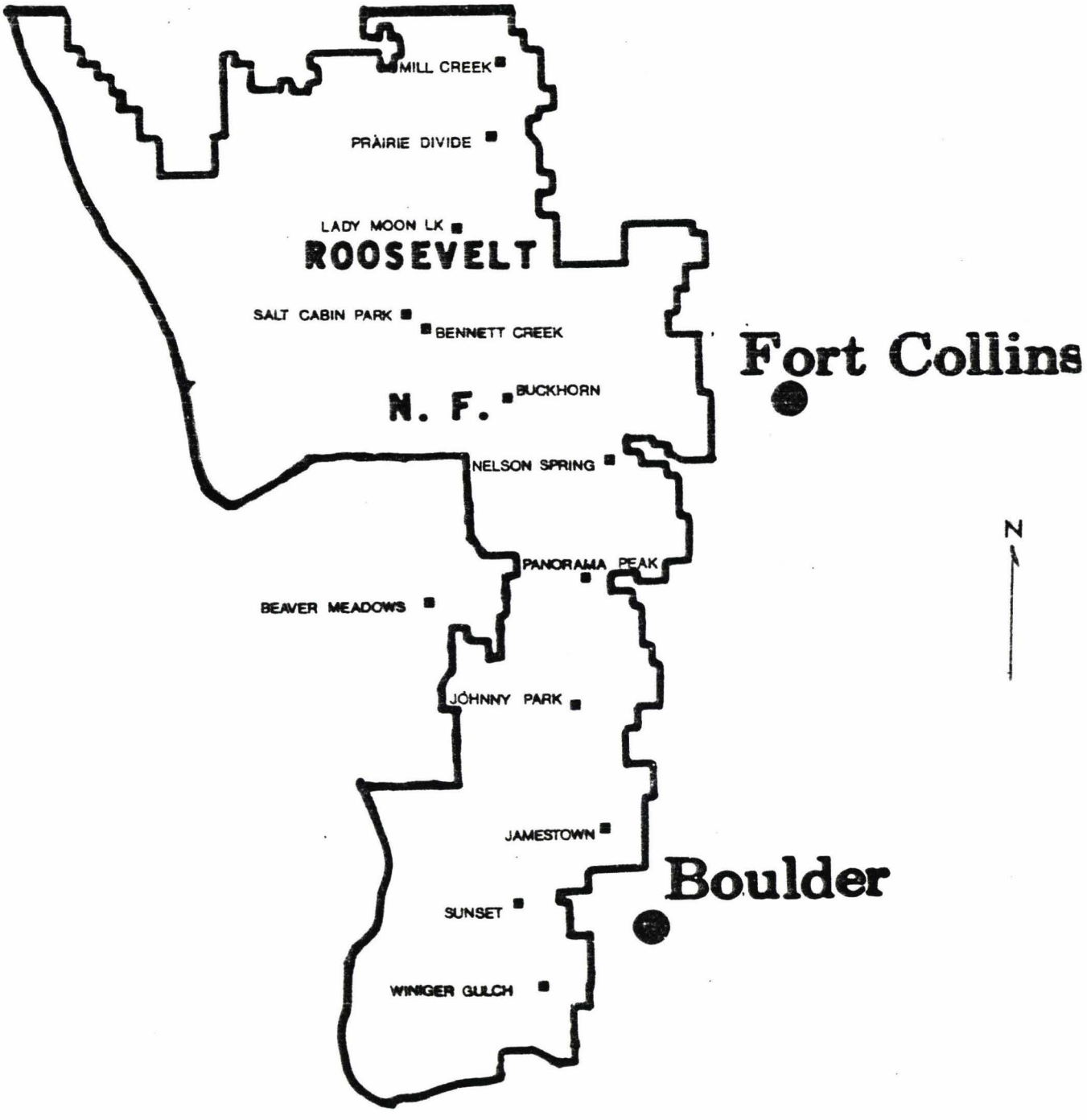

MILL CREEK
PRAIRIE DIVIDE
LADY MOON LK
ROOSEVELT
SALT CABIN PARK
BENNETT CREEK
Fort Collins
N. F.
BUCKHORN
NELSON SPRING
N
PANORAMA PEAK
BEAVER MEADOWS
JOHNNY PARK
JAMESTOWN
Boulder
SUNSET
WINIGER GULCH

FIGURE 3

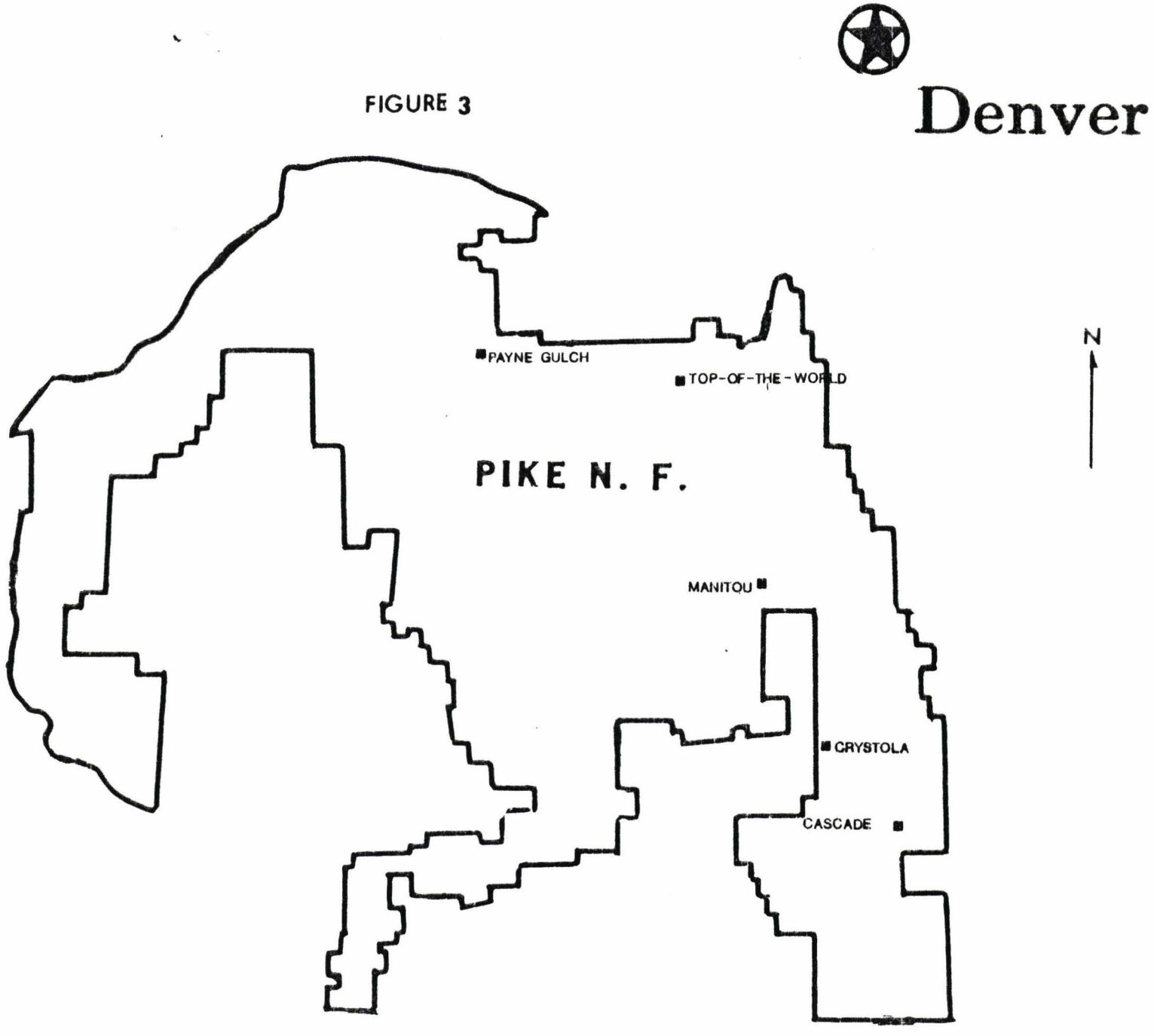
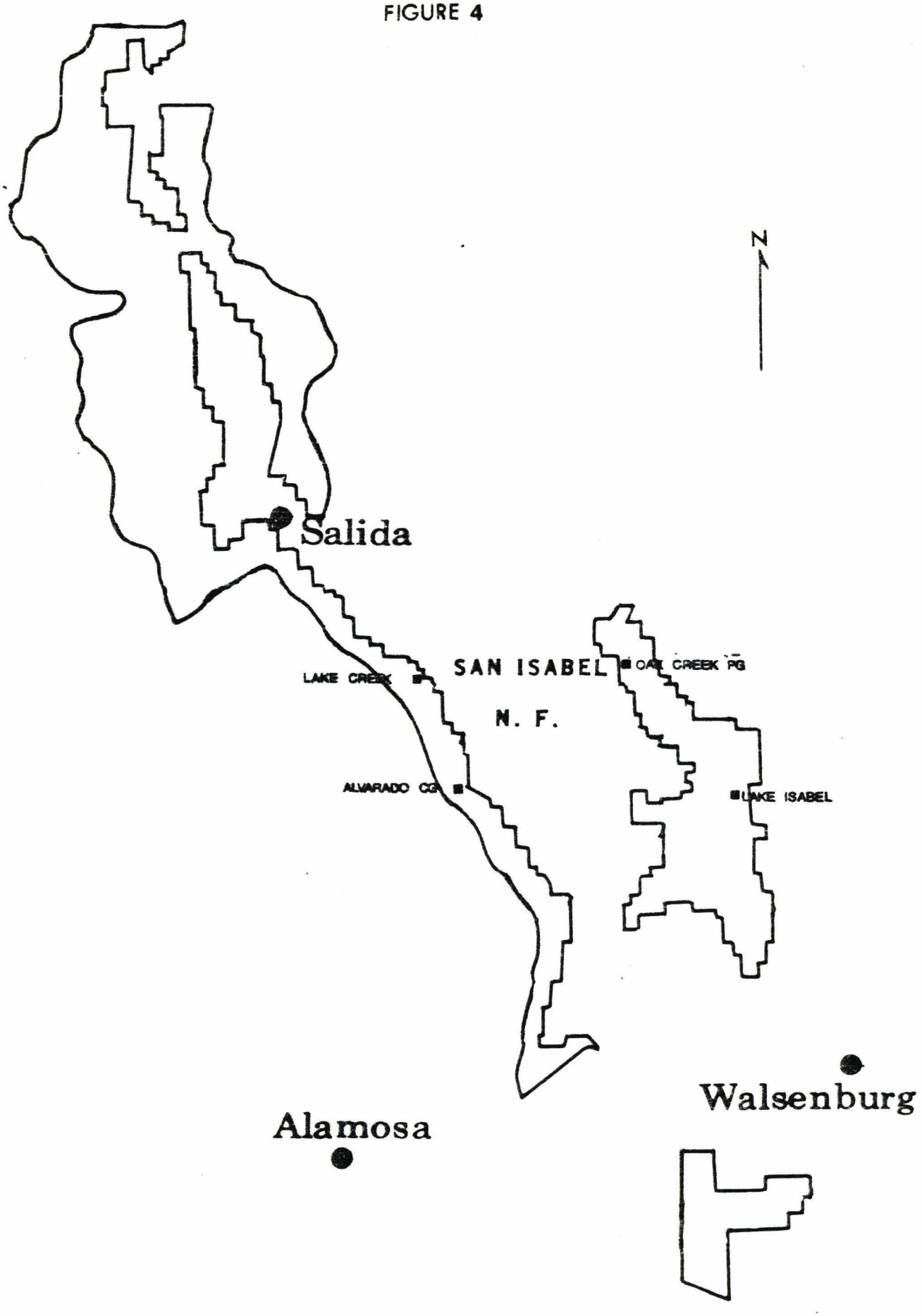

Denver
N
PAYNE GULCH
TOP-OF-THE-WORLD
PIKE N. F.
MANITOU
CRYSTOLA
CASCADE

FIGURE 4


N
Salida
SAN ISABEL
N. F.
LAKE CREEK
OAK CREEK PG
ALVARADO CG
LAKE ISABEL
Walsenburg
Alamosa